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ORIGINAL ARTICLE

Bio-bibliometrics to analyze research output at the author level: A case study of the clinical scientist and orthopedist Dr. Raju Vaishya

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ABSTRACT

Objective. This study focused on Professor Dr. Raju Vaishya, an eminent clinical scientist in orthopedics, to analyze his contribution, publication performance, and collaborative networks during the period from 2008 to 2024. The objective of this study was to provide a comprehensive description of Dr. Vaishya's research output, citation metrics, and collaborative endeavors, with the aim of elucidating his research impact within the domain of orthopedics.

Design/Methodology/Approach. A bibliometric analysis was conducted based on Scopus-indexed publications authored by Dr. Vaishya. Bibliometric indicators included total publications, citation counts, annual publication rates, and collaboration types, both nationally and internationally.

Results/Discussion. Dr. Vaishya published a substantial number of articles, with a total of 318 publications receiving 6,834 citations, resulting in an average of 21.49 citations per paper (CPP). A closer look at his publication history revealed that his most prolific period was from 2020 to 2024, during which he produced 208 publications. A significant proportion of his work, 96.22%, was produced through collaborative efforts, including 55.66% of national and 29.24% of international collaborations. Notably, 46 publications were conducted in collaboration with the Southport and Ormskirk NHS Trust, UK, and 13 papers were produced in conjunction with the Royal Orthopaedic Hospital in Birmingham, UK. Furthermore, 33.35% of his publications appeared in foreign journals, predominantly those published in the UK.

Conclusions. This analysis underscored Dr. Vaishya's substantial contributions to the realm of orthopedic research, emphasizing the pivotal role of collaboration in his scholarly pursuits. His achievements served to exemplify the significance of interdisciplinary collaborations and judicious publication decisions in amplifying scholarly impact, thereby establishing a benchmark for future researchers within this discipline.

Keywords: Raju Vaishya; clinical scientist; orthopedics; citation analysis; collaboration analysis; bio-bibliometrics; research productivity.

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1. INTRODUCTION

The research community, particularly eminent scientists, represents a fundamental pillar of the science, technology, and innovation ecosystem. Their contributions have historically served as a source of inspiration for the younger generation, motivating them to pursue excellence in their respective fields. Many renowned scientists have either founded institutions or inspired the formation of research initiatives, ensuring that their legacies endure and their values are transmitted to future scholars. Analyzing the contributions and evaluating the research performance of these eminent scientists through bibliometric methods has emerged as a vital area of study within bibliometrics. This line of research is often referred to by various terminologies such as "information profile," "microbibliometrics," "bio-bibliometrics," "scientometric portrait," and "biobibliometrics." Such research aims to establish a functional link between biographical data and publication-based bibliometric indicators. The term "biobibliometrics" was first introduced by Sen and Gan (1990) to describe the bibliometric analysis and assessment of an individual scientist's contributions to research papers and other scholarly works. A review of literature reveals numerous biobibliometric studies that have focused on individual scientists, including Nobel laureates. Among these, Kademani and collaborators have explored the scientometric profiles of notable figures such as Sir C. V. Raman (Kademani, *et al.,* 1994), R. Chidambaram (Kalyane & Kademani, 1995; Kappi *et al.,* 2020), Vikram Sarabhai (Kademani *et al.,* 2000), among others. In the medical and related fields, bibliometric analyses have provided insights into the contributions of distinguished scholars, including Harald zur Hausen (Munnoli, *et al.,* 2011), a Nobel laureate recognized for his discovery of the human papillomavirus and its association with cervical cancer. These studies not only illuminate the scholarly achievements of these scientists but also highlight their influence on their fields and future generations of researchers.

Professor Dr. Raju Vaishya (born on March 7, 1960, in Gwalior, India) is a distinguished clinical scientist and leader in orthopedics with over three decades of notable contributions to the field, particularly in arthroplasty and arthroscopy. He has a venerable academic background, having received his medical degree from a prestigious institution and gaining specialized training that established him as a respected expert. Throughout his career, Dr. Vaishya has held esteemed positions in reputable medical institutions, like Gajra Raja Medical College, Gwalior (India), Robert Jones and Agnes Hunt Orthopaedic Hospital, Oswestry (UK), Royal Liverpool Children's Hospital, Alder Hey, Liverpool (UK), and Indraprastha Apollo Hospitals, New Delhi (India), where he has played a crucial role in both clinical practice and academic development. With 318 research articles indexed in Scopus from 2008 to 2024, his prolific output showcases not only his expertise but also his commitment to addressing critical challenges in orthopedics through national and international collaborations. In addition to his research, he is a devoted mentor, actively engaging in workshops and seminars and fostering a collaborative environment among orthopedic professionals, further solidifying his influence in education and practice. Dr. Vaishya's work has established him as a prominent figure and inspirational role model in the orthopedic community (Apollo Hospitals, 2024; Wikipedia, 2024).

The primary aims of this study are: (a) to describe the scholarly contributions of Dr. Raju Vaishya over his publishing career from 2008 to 2024, as measured through his publication and citation metrics; (b) to analyze the impact of collaborative research, both national and international, on his overall publication output; (c) to identify the key journals and publication trends associated with his work in clinical orthopedics, particularly in arthroplasty and arthroscopy; (d) to analyze the characteristics of high-cited publications and assess their significance; and (e) to offer insights and inspiration for aspiring scholars by showcasing the collaborative networks and interdisciplinary engagement fostered by Dr. Vaishya throughout his career.

2. METHODOLOGY

This bibliometric study examines the publication output of Dr. Raju Vaishya, with data collected from Elsevier's Scopus database on November 11, 2024, under Scopus Author

Identifier No: 6602902951. As of this date, Dr. Vaishya has 415 indexed publications in Scopus, covering the period from 1990 to 2025. His first publication appeared in 1990, with 11 papers published between 1990 and 1993, and a significant increase to 403 papers from 2008 to 2025; notably, no publications were indexed from 1994 to 2007. While his early work consisted of 11 publications, his regular research output resumed in 2008 and continues to this day. For this study, we focused on 318 of Dr. Raju Vaishya's publications from 2008 to 2024, which include articles, reviews, letters, editorials, book chapters, conference papers, and short surveys. Letters to editors and erratum were excluded as they are not considered significant contributions. Using Scopus's advanced search, the following strategy was employed:

> "AU-ID ("Vaishya, Raju" 6602902951) AND (EXCLUDE (DOCTYPE, "le") OR EXCLUDE (DOCTYPE, "er") OR EXCLUDE (DOCTYPE, "tb")) AND (EXCLUDE (PUBYEAR, 2025)) AND (EXCLUDE (PUBYEAR, 1993) OR EXCLUDE (PUBYEAR, 1992) OR EXCLUDE (PUBYEAR, 1991) OR EXCLUDE (PUBYEAR, 1990))."

This search retrieved 318 documents on November 11, 2024, from which bibliographic data were extracted and analyzed to align with the study's objectives. The analysis focused on the distribution of publications and citations by year, categorization by subject areas, preferred communication channels, national and international collaborations, and characteristics of high-cited papers (HCPs). Various bibliometric indicators, based on publications, citations, collaborations, and journal impact factors (IFs), were employed to evaluate Dr. Raju Vaishya's research contributions and performance. Some of the collaboration indicators used in this study include collaboration rate (CR), which is defined as the ratio of the number of multi-authored papers to the total number of papers published over a five- to six-year period and the collaboration coefficient (CC), as proposed by Ajiferuke *et al.* (1988). The CC offers a single measure for assessing collaborative research. It is based on fractional productivity, a concept developed by Price and Beaver (1966). The formula for calculating the CC is as follows: $$CC = 1 - \sum_{j = 1}^k (1/f_j)$$, where f_j represents the number of papers with j authors, N is the total number of research papers published, and k is the highest number of authors for any paper. Before presenting the bibliometric analysis, we will provide a brief overview of Dr. Vaishya's research profile to aid in understanding his contribution to the subsequent analysis.

3. RESULTS

3.1. Publication overview

The quantitative and qualitative analysis of Dr. Raju Vaishya's 318 Scopus-indexed publications shows a pattern of growth and decline from 2008 to 2024. His publication count increased from just 1 in 2008 to 43 in 2024, with peaks of 50 publications in 2020 and 47 in 2021 (Figure 1).

Throughout this period, Dr. Vaishya demonstrated a substantial average annual growth rate of 44%. When examining cumulative publication data over three five- to six-year period blocks, the publication numbers increased significantly: from 18 publications during 2008-2013 to 92 during 2014-2019, and further to 208 publications during 2020-2024, reflecting growth rates of 411.1% and 126.09%, respectively. His average productivity was three papers per year (2008-2013) in the first six years of his active research career, which rose to 15.33 papers per year during 2014-2019 and then surged to an average of 41.6 papers per year during 2020-2024. Dr. Vaishya's publications have collectively received a total of 6,859 citations, averaging 21.49 CPP. The citation impact for his cumulative publications initially declined from 28.17 CPP in 2008-2013 to 9.64 CPP in 2014-2019 before rising again to 26.15 CPP in 2020-2024. Furthermore, the contribution to his total citations exhibited considerable growth, with shares increasing from 7.41% (2008-2013) to 13% (2014-2019), and reaching an impressive 79.59% (2020-2024). In terms of publication types, Dr. Vaishya's work comprises 181 original articles (56.92%) and 76 reviews (23.90%), making up most of his total publications. The original articles have the highest citation impact with 27.28 CPP, followed by reviews at 19.72 CPP (Table 1).

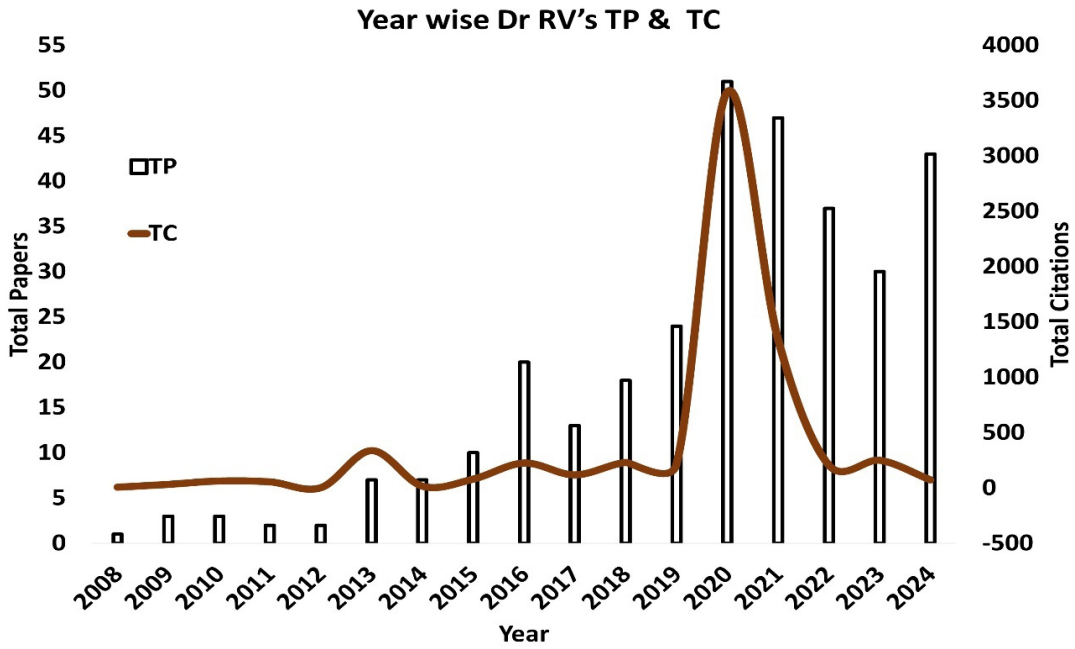

Figure 1. Publication trends and citation patterns of Dr. Raju Vaishya (2008-2024).

Year	TP	TC	CPP	FP	FA	CA	Intra-departmental	Inter-institutional collaboration	
								National	International (NCP)
2008	1	9	9.00	0	0	0	0	0	1
2009	3	34	11.33	0	3	0	0	3	0
2010	3	65	21.67	0	2	0	1	2	0
2011	2	57	28.50	0	1	0	0	2	0
2012	2	4	2.00	0	1	1	2	0	0
2013	7	339	48.43	0	7	5	2	5	0
2014	7	18	2.57	0	7	7	1	6	1
2015	10	82	8.20	0	9	3	7	3	0
2016	20	227	11.35	0	17	7	18	0	2
2017	13	120	9.23	1	12	5	8	4	1
2018	18	232	12.89	0	16	5	9	8	1
2019	24	213	8.88	0	13	2	13	9	2
2020	51	3577	70.14	2	10	6	12	23	16 (11)
2021	47	1346	28.64	4	7	5	11	16	20 (20)
2022	37	209	5.65	3	13	7	10	11	16 (4)
2023	30	252	8.40	7	12	8	1	12	17 (7)
2024	43	75	1.74	5	27	19	6	21	16 (9)
2008-2013	18	508	28.22	0	14	6	5	12	1
2014-2019	92	892	9.70	1	74	29	54	31	7
2020-2024	208	5459	26.25	21	69	45	40	83	85
2008-2024	318	6859	21.57	22	157	80	99	126 (51)	93 (51)

Table 1. Annual publications and citations of Dr. Raju Vaishya's publications (2008-2024).
Note. TP: Total publications; TC: Total citations; CPP: Citations per paper; FP: Funded papers; FA: First author paper; CA: Corresponding author paper; NCP: National collaborative publications among international collaborative papers.

Dr. Raju Vaishya's work includes 21 publications (6.60% of his total of 318) that received external funding from 41 international agencies, collectively garnering 1,049 citations, averaging 49.95 CPP. Among these funded projects, RWTH Aachen University in Germany contributed the most, with five publications. This was followed by the National Institutes of Health in the USA, with four publications, and the U.S. Department of Health and Human Services, with three publications.

3.2. Study of collaboration indices and types of collaboration

3.2.1. Collaboration indices

3.2.1.1. Collaboration rate

During the years 2008-2024, Dr. Raju Vaishya published only 12 single-authored papers (3.77%), with the remainder being multi-authored. The analysis revealed that the overall CR for this period was 0.96, which indicates a strong preference for collaborative work. Notably, the value of CR systematically increased from 0.88 in 2008-2013 to 0.98 in 2020-2024, highlighting Dr. Vaishya's inclination to engage in teamwork rather than working independently. This analysis sheds light on the extent of both multi-authored and single-authored papers he published during the study period.

3.2.1.2. Collaboration coefficient

The Collaborative Coefficient (CC), as proposed by Ajiferuke *et al.* (1988), provides a single measure for assessing the extent of collaborative research. According to the authors, the CC approaches zero when single-authored papers dominate, while it increases ($0 \leq CC < 1$) as the proportion of multi-authored papers rises. However, the CC does not reach the maximum value of 1 unless the number of authors is unlimited. The formula for CC is as follows:

$$CC = 1 - \frac{\sum_{j=1}^{A} \left(\frac{1}{j}\right) fi}{N}$$

where 'f_j' represents the number of papers with 'j' authors, 'A' is the maximum number of authors per paper, and 'N' is the total number of papers.

This formula implies that a higher CC reflects a greater likelihood of publications involving multiple authors. Using this formula, the calculated CC for Dr. Vaishya's publications was found to be 0.66, indicating an increasing trend in collaborative authorship. As the proportion of collaborations among authors rises, the number of multi-authored papers increases. An analysis of Dr. Vaishya's author distribution, detailed in Supplementary Tables S1 and S2, shows that the CC increased from 0.61 during 2008-2013 to 0.72 during 2020-2024. This trend suggests that Dr. Vaishya has progressively collaborated with more scientists over time, resulting in a higher volume of co-authored publications.

3.2.2. Authorship status in collaborative papers

The order of appearance of author names in published documents is considered a valuable indicator of individual contributions, as not all positions hold the same significance. Data presented in Supplementary Table S3 reveals that Dr. Raju Vaishya collaborated with over 700 authors to produce 318 papers. He served as the primary or first author on 159 papers (50.0%), while in the remaining 159 papers (50.0%), he contributed as a co-author. Among his co-authored works, he held the second position in 42 papers (13.21%) and the third position in 52 papers (16.35%). He occupied the fourth position in 24 papers (7.55%) and held positions 5-10 in the remainder. These findings indicate that Dr. Vaishya has maintained a prominent authorship position (either first or second author) in a significant number of his publications (Kappi *et al.,* 2021).

3.2.3. Type of collaboration

3.2.3.1. Intra-departmental collaboration

Out of Dr. Raju Vaishya's 318 publications, 99 involved intra-departmental collaboration, meaning they included participants from only one organization. Among these, 12 papers had independent authorship, while the remaining 87 involved two or more authors.

3.2.3.2. Inter-institutional collaboration

Dr. Vaishya's research includes 219 publications (126 national and 93 international) that featured collaboration among two or more organizations.

3.2.3.3. International collaboration

Among Dr. Vaishya's 318 publications, 93 (29.24%) were involved in international collaboration. The number of international collaborative papers (ICPs) increased gradually from just one paper (involving a single foreign country) during 2008-2013 to seven papers (involving four countries), eventually reaching a peak of 88 papers with collaborations (from 14 countries) during 2020-2024. These 93 ICPs registered a total of 2,466 citations (averaging 26.52 CPP). Dr. Vaishya developed scientific collaborations with 276 foreign authors affiliated with 71 organizations across 15 countries during his 17 years of research (2008-2024). Notably, 19 organizations and 22 authors from four countries were particularly significant, having collaborated on two or more papers with him. Table 2 details the participation and contributions of the top eight foreign countries in Dr. Vaishya's 93 ICPs. Dr. Vaishya's international collaboration network shows that: (i) the highest number of collaborations were with European countries, specifically the UK (67 papers, 69.79% share), Italy (23 papers, 23.96% share), and Germany (13 papers, 13.54% share); (ii) there was a moderate collaboration with the USA (six papers, 6.25% share), Nepal (five papers, 5.21% share), and France (three papers, 3.12% share); and (iii) limited collaboration with countries such as Kenya and Nigeria (two papers each), as well as Canada, Denmark, Japan, Oman, South Africa, Switzerland, and the UAE (one paper each). In terms of citation impact among the top eight collaborating countries, publications with international co-authors from the UK achieved the highest average CPP at 33.76, followed by the USA at 10.5 and Nigeria at 10.0.

S. No.	Foreign country	TP	TC	CPP
1	UK	67	2,262	33.76
2	Italy	23	130	5.65
3	Germany	13	44	3.38
4	USA	6	63	10.50
5	Nepal	5	26	5.20
6	France	3	13	4.33
7	Kenya	2	8	4.00
8	Nigeria	2	20	10.00
	Other seven countries	7	918	131.14

Table 2. Contribution of top 15 foreign countries in Dr. Raju Vaishya's publications.
Note. TP: Total publications; TC: Total citations; CPP: Citations per paper.

Dr. Vaishya's (India) international collaborations network with 15 foreign countries spread across seven clusters, showcasing varying academic engagement (Figure 2).

Seventy-one foreign organizations participated with Dr. Raju Vaishya in 93 ICPs. Their participation increased significantly, from just two organizations during 2008-2013 to seven during 2014-2019, and then to 68 during 2020-2024. Among these 71 organizations, 19 made notable contributions by collaborating on two or more papers, while the remaining organizations participated in only one paper each. Table 3 lists the 12 most frequently collaborating foreign organizations, each involved in three or more ICPs. Among the 71 foreign collaborating organizations, (i) the most significant collaborations were with Southport and Ormskirk NHS Trust in the UK, which contributed to 46 papers (47.92% share), and the Royal Orthopaedic Hospital in Birmingham, which contributed to 13 papers (13.54% share); (ii) moderate collaboration was observed with six organizations, including the Academic Hospital of Bolzano (SABES-ASDAA) in Italy, RWTH Aachen University Hospital in

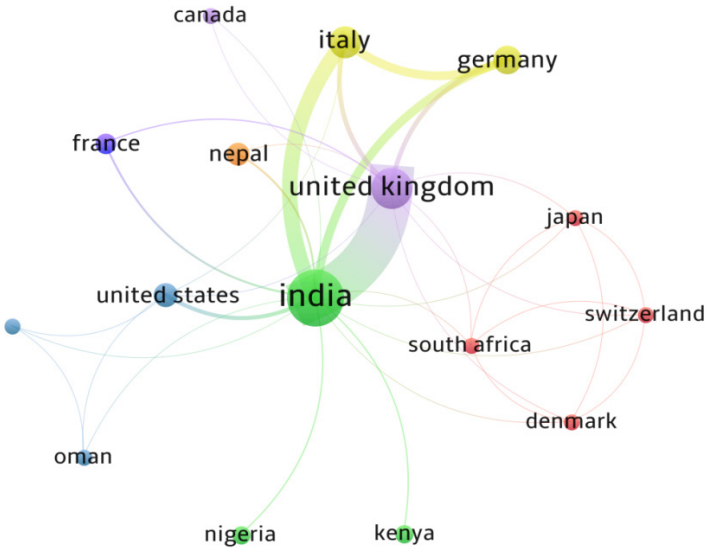

Figure 2. Dr. Raju Vaishya's collaboration network with 15 countries.

Germany, IRCCS Ospedale Galeazzi-Sant'Ambrogio in Milan, Queen Mary University of London, Barts and the London in the UK, Eifelklinik St. Brigida in Simmerath, and the University of Salerno in Baronissi, Italy, each contributing between five to nine papers (with shares ranging from 5.21% to 9.38%); and (iii) the lowest level of collaboration was with the remaining foreign organizations. Dr. Vaishya's parent organization and its international collaborations network with top 12 foreign organizations are shown in Figure 3.

S. No.	Name of the foreign organization	TP	TC	CPP	TP (%)
1	Southport and Ormskirk NHS Trust, UK	46	1,279	27.8	47.92
2	Royal Orthopaedic Hospital, Birmingham, UK	13	89	6.85	13.54
3	Academic Hospital of Bolzano (SABES-ASDAA), Italy	9	21	2.33	9.38
4	RWTH Aachen University Hospital, Aachen, Germany	8	36	4.5	8.33
5	IRCCS Ospedale Galeazzi-Sant'Ambrogio, Milan, Italy	7	35	5	7.29
6	Queen Mary University of London, UK	7	29	4.14	7.29
7	Università Degli Studi di Milano, Milan, Italy	6	34	5.67	6.25
8	Eifelklinik St. Brigida, Simmerath, Germany	5	96	19.2	5.21
9	University of Salerno, Baronissi, Italy	5	96	19.2	5.21
10	University La Sapienza, Rome, Italy	3	3	1	3.13
11	Groupe ELSAN, Clinique Chirurgicale, France	3	13	4.33	3.13
12	Keele University, School of Pharmacy and Bioengineering, UK	3	7	2.33	3.13

Table 3. Profile of top 12 foreign organizations collaborating in three or more papers with Dr. Vaishya. **Note.** TP: Total papers; TC: Total citations; CPP: Citations per paper.

In Dr. Raju Vaishya's 93 ICPs, 141 foreign authors participated, increasing significantly from three during 2008-2013 to eight during 2014-2019 and then skyrocketing to 268 during 2020-2024. Among the 141 authors, 23 collaborated on two papers, while eight contributed to three or more papers. Table 4 details the contributions of eight foreign authors who made three or more contributions. The most significant contribution among foreign authors came from Karthikeyan P. Iyengar (Southport and Ormskirk NHS Trust, Southport, UK) with 44 papers and an average of 14.02 CPP. He was followed by Rajesh Botchu (Royal Orthopaedic Hospital, Birmingham, UK) with 13 papers and a CPP of 6.85, and Filippo Migliorini (Germany), who also contributed 13 papers with a CPP of 3.38. Other notable contributors

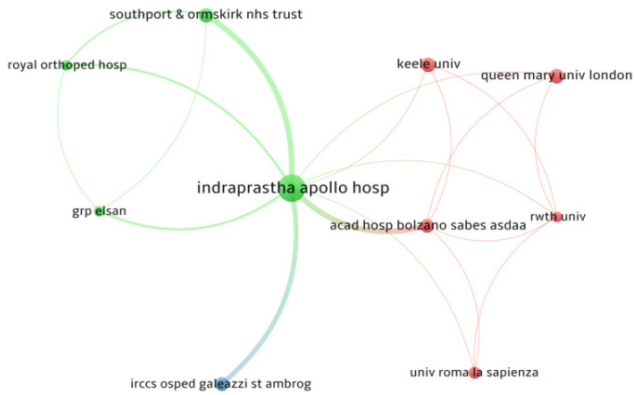

Figure 3. Top foreign organizations collaborating with Indraprastha Apollo Hospital.

include Riccardo D'Ambrosi (IRCCS Ospedale Galeazzi-Sant'Ambrogio, Milan, Italy) with six papers (CPP of 5.33), Nicola Maffulli (University of Salerno, Baronissi, Italy) with eight papers (CPP of 4.00), Andreas Bell (Eifelklinik St. Brigida, Simmerath, Germany) with four papers (CPP of 4.22), Jaly Ibrahim (Southport and Ormskirk NHS Trust, Southport, UK) with three papers (CPP of 27.67), and M. M. Scarlat (Groupe ELSAN, Clinique Chirurgicale, St. Michel, Toulon, France) with three papers (CPP of 4.33) (Table 4).

S. No.	Name of author	Affiliation	TP	TC	CPP
1	Karthikeyan P. Iyengar	Southport and Ormskirk NHS Trust, Southport, UK	44	617	14.02
2	Rajesh Botchu	Royal Orthopaedic Hospital, Birmingham, UK	13	89	6.85
3	Filippo Migliorini	RWTH University Hospital of Aachen, Germany	13	44	3.38
4	Nicola Maffulli	University of Salerno, Baronissi, Italy	8	32	4.00
5	Riccardo D'Ambrosi	IRCCS Ospedale Galeazzi-Sant'Ambrogio, Italy	6	32	5.33
6	Andreas Bell	Eifelklinik St. Brigida, Simmerath, Germany	4	17	4.22
7	Jaly Ibrahim	Southport and Ormskirk NHS Trust, UK	3	83	27.67
8	M. M. Scarlat	Groupe ELSAN, Clinique Chirurgicale, France	3	13	4.33

Table 4. Profile of top eight foreign authors collaborating in three or more papers with Dr. Raju Vaishya. **Note.** TP: Total papers; TC: Total citations; CPP: Citations per paper.

Figure 4 presents the Dr. Raju Vaishya's collaboration with top eight foreign authors, across five clusters. Cluster 1 includes Nicola Maffulli (8 publications, Total Link Strength or TLS 22) and Filippo Migliorini (13 publications, TLS 29). Cluster 2 places Dr. Raju Vaishya centrally (317 publications, TLS 107), alongside Karthikeyan P. Iyengar (TLS 67) and Rajesh Botchu (TLS 24). Clusters 3-5 feature emerging partnerships, with Riccardo D'Ambrosi, and Jaly Ibrahim contributing smaller but promising collaborations.

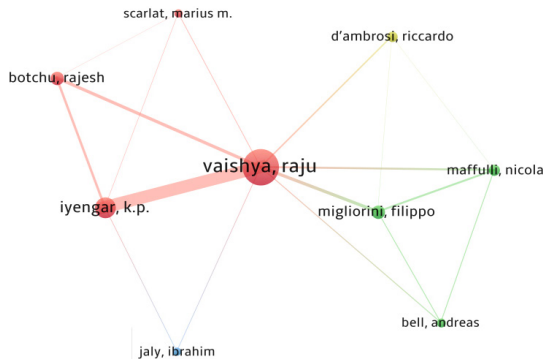

Figure 4. Dr. Raju Vaishya's collaboration network with top foreign authors.

3.2.3.4. National collaboration

Of Dr. Raju Vaishya's 318 publications, 177 (55.66%) involved collaboration with 64 national organizations. The 177 national collaborative papers also include 51 ICPs, which have also the participation of more than one Indian organization. Among these, 31 organizations contributed to one co-authored paper each, five collaborated on two papers each, nine worked together on three papers, and 18 organizations were involved in 4-36 co-authored papers each. The number of national collaborative publications increased significantly over the years, rising from 12 during 2008-2013 to 30 during 2014-2019 and reaching 137 during 2020-2024. Together, these publications received a total of 4,763 citations (averaging 26.61 CPP). Furthermore, the number of collaborating organizations that contributed two or more co-authored papers grew from four in 2008-2013 to 12 in 2014-2019 and then to 29 in 2020-2024. Dr. Vaishya's national scientific collaboration network spans 18 Indian states and union territories. The most significant number of institutional collaborators originated from Delhi (20 organizations), followed by Maharashtra (five) and both Madhya Pradesh and Punjab (five each). Andhra Pradesh, Karnataka, Kerala, and Telangana each had three collaborating organizations, while Bihar, Chandigarh, Gujarat, Haryana, Tamil Nadu, and Uttarakhand contributed two each. Himachal Pradesh, Odisha, Rajasthan, and West Bengal accounted for one organization each. Among the 64 national collaborating organizations, Dr. Vaishya worked closely with 27 that contributed three or more collaborative papers (Figure 5). Table 5 lists the top 15 national collaborating organizations that contributed four or more publications with Dr. Vaishya. The most productive institutional collaborations, yielding between 10 and 36 papers, came from Dr. Ram Manohar Lohia Hospital (36 papers), Safdarjung Hospital and VMMC (25 papers), CSIR-NISTADS (18 papers), and Jamia Millia Islamia (17 papers). Other notable collaborating institutions include Sancheti Hospital in Pune (14 papers), SKDGOC, Sri Dhaatri Orthopaedic, Maternity & Gynaecology Center in Vijayawada (13 papers), and the AllIndia Institute of Medical Sciences (11 papers), and Fortis C Doc Hospital contributed 10 papers. Dr. Vaishya's (parent organization) national collaborations network with top 10 Indian organizations is shown in Figure 5.

S. No.	Collaborating Indian organization	TP	TC	CPP
1	Dr. Ram Manohar Lohia Hospital, New Delhi	36	951	26.42
2	Safdarjung Hospital and VMMC, New Delhi	25	364	14.56
3	CSIR-NISTADS, New Delhi	18	72	4.00
4	Jamia Millia Islamia, New Delhi	17	2142	126.00
5	Sancheti Hospital, Pune, Maharashtra	14	347	24.79
6	SKDGOC, Sri Dhaatri Orthopaedic, Maternity & Gynaecology Center, Vijayawada, Andhra Pradesh	13	208	16.00
7	All India Institute of Medical Sciences (AIIMS), New Delhi	11	72	6.55
8	Fortis C DOC Hospital, New Delhi	10	202	20.20
10	I. K. Gujral Punjab Technical University Hoshiarpur, Punjab	9	1160	128.89
11	Yenepoya (Deemed University), Mangalore	9	20	2.22
12	Parul Institute of Medical Sciences and Research, Parul University, Vadodara, Gujarat	7	44	6.29
13	University College of Medical Sciences, New Delhi	6	116	19.33
14	All India Institute of Medical Sciences, Rae Bareilly	6	294	72.33
15	Kerala University of Health Sciences, Kozhikode, Kerala	5	7	1.40

Table 5. Top 15 Indian organizations collaborating with Dr. Raju Vaishya in more than three papers. **Note.** TP: Total papers; TC: Total citations; CPP: Citations per paper.

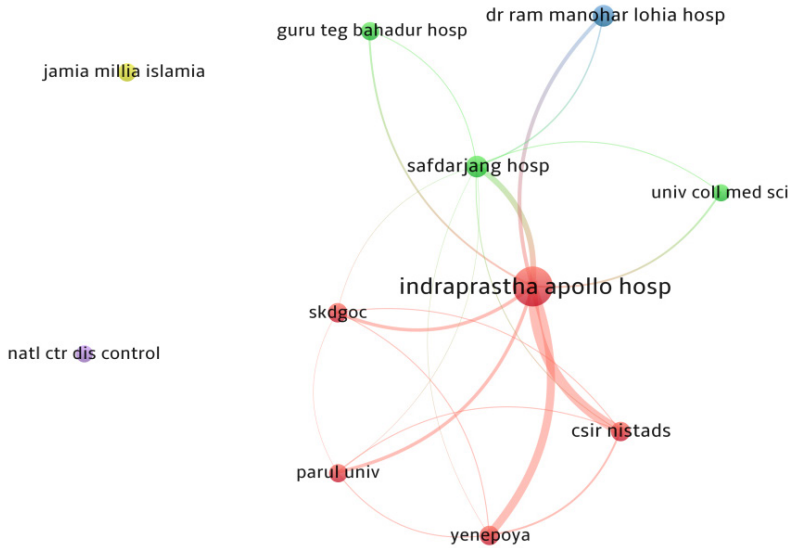

Figure 5. Top Indian organizations collaborating with Dr. Raju Vaishya.

Dr. Raju Vaishya collaborated with 473 Indian authors across 179 national collaborative papers. Among these authors, 396 contributed to one co-authored paper each, while 35 collaborated on two papers, 14 on three papers, eight on four papers, and 19 authors contributed between 6 and 132 papers. Notably, 77 authors contributed to two or more papers, with their participation increasing from 4 during 2008-2013 to 21 during 2014-2019 and further to 61 during 2020-2024. Of the 77 Indian authors with two or more contributions, 20 have worked or are currently working with Dr. Vaishya at Indraprastha Apollo Hospital, New Delhi. Their contributions, along with the number of collaborative papers, include A. Vaish (132), V. Vijay (57), A. K. Agarwal (42), A. Sibal (6), and N. Gupta, A. H. Ansari, N. Goyal, and A. Jena (4 each). Additionally, S. Babu, P. Baweja, P. Rana, R. Sardana, and S.S. Taneja each contributed three papers. In contrast, Y. Y. S. Basu, A. R. Byukchhe, V. P. Birla, H. Butta, R. Hasija, G. K. Jha, V. Kuma, L. Mendiratta, N. Pawar, T. Shukla, L. K. Singh, and S. Swami contributed two papers each. Among the 57 other Indian authors affiliated with different hospitals, including Indraprastha Apollo Hospital, who contributed two or more papers, the following demonstrated the highest publication productivity:

1. *High productivity (9-37 papers):* V. K. Jain (37), B. M. Gupta (19), M. K. Patralekh (15), M. Javaid, A. Haleem (13 each), A. Misra, M. M. Kappi, and G. M. N. Mamdapur (10 each), S. Bahl, and H. Lal (9 each).
2. *Medium productivity (six to eight papers):* A. P. Singh (eight), Karthik Vishwanathan (seven), G. K. Upadhaya (six), P. Gopinathan (six).
3. *Low productivity (three to four papers):* J. S. Bhadani, R. Garg, L. Maini, and R. Malhotra (four each), and P. Agrawal, D. Gautam, S. Ghosh, R. Itcha, M. Jeyaraman, S. Reddy, D. Sharma, R. Suman, and I. H. Khan (three each), along with A. Agarwal, A. Aggarwal, K. S. Ali, A. Annapareddy, V. Baburaj, V. Bagaria, and S. Dhall (two each).

Table 6 lists the top 19 Indian collaborating authors outside Indraprastha Apollo Hospital who have collaborated with Dr. Vaishya on four or more papers. Among the 41 national collaborating authors who worked outside Indraprastha Apollo Hospital and contributed three or more papers, the most impactful collaborations, measured by CPP, include:

1. *High impact (40+):* I. H. Khan, R. Suman (238.67 CPP), M. Javaid (164.23 CPP), A. Haleem (156.38 CPP), S. Bahl (128.89 CPP), G. K. Upadhyaya (49.0 CPP), and V. K. Jain (44.81 CPP).
2. *Medium impact (10-40):* L. Maini (25.75 CPP), A. Misra (20.2 CPP), A. P. Singh (19.5 CPP), S. Reddy (19.33 CPP), H. Lal (16.11 CPP), S.

B. S. Kambhampati (16.0 CPP), V. Kumar (14.0 CPP), S. Patel (14.0 CPP), R. Garg (11.0 CPP), and M. K. Patralekh (10.27 CPP).

Dr. Vaishya's national collaborations network with top Indian authors is shown in Figure 6.

S. No.	Name of the author	Affiliation of the author	TP	TC	CPP
1	V. K. Jain	Dr. R M Lohia Hospital, New Delhi	37	1658	44.81
2	B. M. Gupta	NISTADS, New Delhi	19	72	3.79
3	M. K. Patralekh	Safdarjung Hospital and VMMC, New Delhi, India	15	154	10.27
4	M. Javaid	Jamia Millia Islamia, New Delhi	13	2135	164.23
5	A. Haleem	Jamia Millia Islamia, New Delhi	13	2033	156.38
6	S. B. S. Kambhampati	SKDGOC, Sri Dhaatri Orthopaedic, Maternity & Gynaecology Centre, Vijayawada, Andhra Pradesh, India	13	208	16.00
7	A. Misra	Fortis C-Doc Hospital, New Delhi	10	202	20.20
8	Mallikarjun Kappi	Government First Grade College, Jagalur, Karnataka	10	42	4.20
9	G. M. N. Mamdapur	Yenepoya (Deemed to be University), Mangalore, India	10	20	2.00
10	S. Bahl	I. K. Gujral Punjab Technical University Hoshiarpur Campus, Hoshiarpur, Punjab, India	9	1160	128.89
11	H. Lal	Safdarjung Hospital and VMMC, New Delhi, India	9	145	16.11
12	A. P. Singh	Punjab Civil Medical Services, Mukerian, Punjab	8	156	19.50
13	Karthik Vishwanathan	Parul Institute of Medical Sciences and Research, Vadodara, Gujarat	7	44	6.29
14	G. K. Upadhaya	All India Institute of Medical Sciences, Rai Bareilly, Uttar Pradesh	6	294	49.00
15	P. Gopinathan	Kerala University of Health Sciences, Kerala	6	11	1.83
16	J. S. Bhadani	Paras HMRI Hospital, Patna, Bihar	4	3	0.75
17	R. Garg	All India Institute of Medical Sciences, New Delhi	4	44	11.00
18	L. Maini	Maulana Azad Medical College, New Delhi	4	103	25.75
19	R. Malhotra	All India Institute of Medical Sciences, New Delhi	4	15	3.75

Table 6. Profile of top 19 Indian authors outside Indraprastha Apollo Hospital, New Delhi, collaborating with Dr. Raju Vaishya on more than four papers. **Note.** TP: Total papers; TC: Total citations; CPP: Citations per paper.

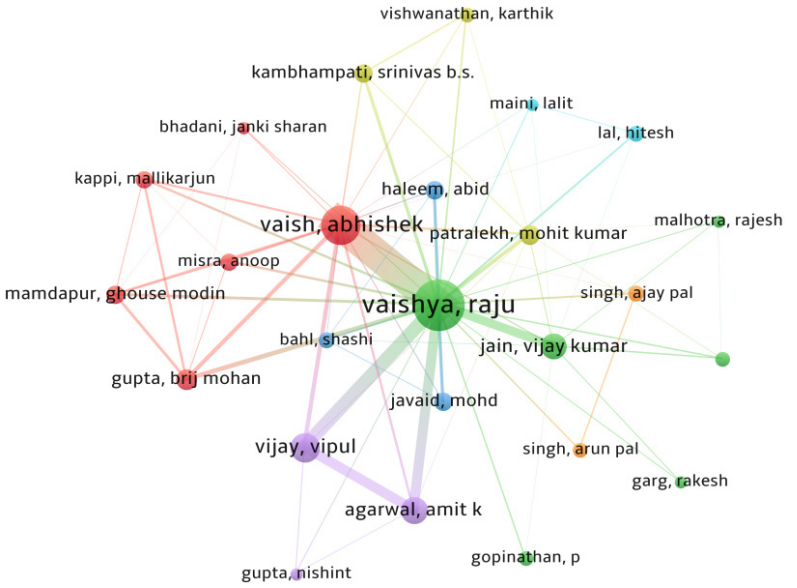

Figure 6. Dr. Raju Vaishya's collaboration with the top Indian authors.

3.3. High-cited publications

3.3.1. Citation distribution pattern

Citation rates shed light on the impact of published work within the scientific community. Dr. Raju Vaishya's 318 publications garnered a total of 6,859 citations, yielding an average citation rate of 21.57 CPP. An analysis of the citation distribution (Supplementary Table S5) revealed the following: (i) 16.98% (54 papers) of the total publications received no citations. (ii) Conversely, 83.02% of the remaining papers were cited at least once. Specifically, 126 papers (39.62%) received between one and five citations, accounting for 5.02% of the total citation share. Additionally, 50 papers (15.72%) were cited between 6 and 10 times, representing 5.83% of the citation share. The remaining papers were cited as follows: 33 papers (10.38%) received 11-20 citations (7.01% citation share), 29 papers (9.12%) received 21-50 citations (12.83% citation share), and 15 papers (4.72%) received 51-100 citations (15.16% citation share). Notably, 11 papers (3.46%) received between 101 and 967 citations, collectively accounting for 54.15% of the total citation share. Overall, approximately 55.34% of the papers were cited between 1 and 10 times. Further investigation into the 54 uncited papers indicated that 39 were published from 2022 to 2024 and appeared in low-impact journals. This analysis suggests that a significant portion of Dr. Vaishya's research contributions plays an integral role in the broader field of orthopedic research.

3.3.2. Characteristics

Of the 318 publications authored by Dr. Raju Vaishya, 27 (8.49%) are classified as HCPs, having received between 50 and 967 citations. Collectively, these 27 HCPs garnered a total of 4,920 citations, averaging 182.22 CPP. The citation distribution among these HCPs is as follows: three papers received 543-967 citations, eight papers received 101-296 citations, and 16 papers received 50-95 citations. These HCPs were published in nine journals, involving collaboration with 29 organizations (24 Indian and five foreign) and a total of 50 authors (40 Indian and 10 foreign). Among the participating organizations in HCPs, Indian institutions significantly contributed as follows: Dr. Ram Manohar Lohia Hospital, New Delhi, collaborated on eight papers; Jamia Millia Islamia, New Delhi, and I. K. Gujral Punjab Technical University, Hoshiarpur, contributed seven papers each; Safdarjung Hospital and VMMC, New Delhi contributed four papers; G. B. Pant University of Agriculture & Technology, Pant Nagar, and Dr. B. R. Ambedkar National Institute of Technology, Jalandhar contributed three papers each; while other organizations contributed one paper each. From the foreign organizations, Southport & Ormskirk NHS Trust collaborated on 10 papers, with four others contributing one paper each.

Among the 50 contributing authors for Dr. Vaishya's HCPs, prominent Indian authors included A. Vaish (10 papers), V. K. Jain and M. Javaid (seven papers each), and A. Haleem and S. Bahl (six papers each). Other notable contributors were R. P. Singh (four papers), I. K. Khan, G. K. Upadhyaya, A. K. Agarwal, and M. K. Patralekh (two papers each), while other Indian authors each contributed one paper each. The key foreign author, Karthikeyan P. Iyengar (UK), collaborated on 10 papers, with the other nine foreign authors contributing to one paper each. The 27 HCPs were published across nine journals. Notably, the journal *Diabetes and Metabolic Syndrome: Clinical Research and Reviews* published 11 papers, followed by the *Journal of Clinical Orthopaedics and Trauma* (seven papers) and the *Journal of Industrial Integration and Management* (three papers). The remaining journals published one paper each, including the *British Journal of Healthcare Management,* the I*ndian Journal of Orthopaedics, International Orthopaedics, Journal of Clinical and Experimental Hepatology, Nature,* and *Tropical Doctor.* The topics covered by the 27 HCPs include COVID-19 (14 papers), a combination of COVID-19 and orthopedics (four papers), injury and trauma (four papers), arthroscopy (three papers), and both diabetic foot disease and ChatGPT (one paper each). Table 7 lists the top 15 highly cited publications authored by Dr. Vaishya.

3.3.3. Preferred channels of communication

Dr. Raju Vaishya's 318 papers, comprising 316 articles and two book chapters, were published across 69 journals: 44 journals published one

S No.	Authors	Title	Source	Cited
1	Vaishya, R., Javaid, M., Khan, I. H., and Haleem, A.	Artificial intelligence (AI) applications for COVID-19 pandemic	*Diabetes and Metabolic Syndrome: Clinical Research and Reviews,* 2020, 14 (4), pp. 337-339	964
2	Mlcochova, P., Kemp, S. A., *et al.*	SARS-CoV-2 B.1.617.2 Delta variant replication and immune evasion	Nature, 2021, 599 (7883), pp. 114-119	889
3	Javaid, M., Haleem, A., Vaishya, R., Bahl, S., Suman, R., and Vaish, A.	Industry 4.0 technologies and their applications in fighting COVID-19 pandemic	*Diabetes and Metabolic Syndrome: Clinical Research and Reviews,* 2020, 14 (4), pp. 419-422	542
4	Vaishya, R., Chauhan, M., and Vaish, A.	Bone cement	*Journal of Clinical Orthopaedics and Trauma,* 2013, 4 (4), pp. 157-163	295
5	Pratap Singh, R., Javaid, M., Haleem, A., Vaishya, R., and Ali, S.	Internet of medical things (IoMT) for orthopedic in COVID-19 pandemic: Roles, challenges, and applications	*Journal of Clinical Orthopaedics and Trauma,* 2020, 11 (4), pp. 713-717	183
6	Iyengar, K., Upadhyaya, G. K., Vaishya, R., and Jain, V.	COVID-19 and applications of smartphone technology in the current pandemic	*Diabetes and Metabolic Syndrome: Clinical Research and Reviews,* 2020, 14 (5), pp. 733-737	173
7	Iyengar, K., Bahl, S.,Vaishya, R., and Vaish, A.	Challenges and solutions in meeting up the urgent requirement of ventilators for COVID-19 patients	*Diabetes and Metabolic Syndrome: Clinical Research and Reviews,* 2020, 14 (4), pp. 499-501	165
8	Suman, R., Javaid, M., Haleem, A., Vaishya, R., Bahl, S., and Nandan, D.	Sustainability of Coronavirus on different surfaces	*Journal of Clinical and Experimental Hepatology,* 2020, 10 (4), pp. 386-390	138
9	D'Souza, S., Vaishya, R., and Klenerman, L.	Management of radial neck fractures in children: A retrospective analysis of one hundred patients	*Journal of Pediatric Orthopaedics,* 1993, 13 (2), pp. 232-238	116
10	Iyengar, K., Mabrouk, A., Jain, V. K., Venkatesan, A., and Vaishya, R.	Learning opportunities from COVID-19 and future effects on health care system	*Diabetes and Metabolic Syndrome: Clinical Research and Reviews,* 2020, 14 (5), pp. 943-946	105
11	Kambhampati, S. B. S., Vaishya, R., and Vaish, A.	Unprecedented surge in publications related to COVID-19 in the first three months of pandemic: A bibliometric analytic report	*Journal of Clinical Orthopaedics and Trauma,* 2020, 11, pp. S304-S306	101
12	Bahl, S., Singh, R. P., Javaid, M., Khan, I. H., Vaishya, R., and Suman, R.	Telemedicine technologies for confronting covid-19 pandemic: A review	*Journal of Industrial Integration and Management,* 2020, 5 (4), pp. 547-561	95
13	Vaishya, R. and Vaish, A.	Falls in older adults are serious	*Indian Journal of Orthopaedics,* 2020, 54 (1), pp. 69-74	88
14	Vaishya, R., Pariyo, G. B., Agarwal, A. K., and Vijay, V.	Non-operative management of Osteoarthritis of the knee joint	*Journal of Clinical Orthopaedics and Trauma,* 2016, 7 (3), pp. 170-176	70
15	Vaishya, R., Patralekh, M. K., Vaish, A., Agarwal, A. K., and Vijay, V.	Publication trends and knowledge mapping in 3D printing in orthopedics	*Journal of Clinical Orthopaedics and Trauma,* 2018, 9 (3), pp. 194-201	69

Table 7. List of top 15 highly cited papers of Dr. Raju Vaishya.

paper each, 10 journals published two papers each, five journals published three papers each, and the remaining 10 journals published between 4 and 102 papers each. Collectively, these journals contributed 246 papers and received 5,269 citations, accounting for 77.36% of Dr. Vaishya's total publications and 84.95% of his citations. Among the top 15 journals, most have IFs ranging from 0.0 to 4.3, with five journals reporting an IF above 3.0. The most productive journals include *The Journal of Clinical Orthopaedics and Trauma (JCOT)* ranks highest, with 102 publications and 2,603 citations, reflecting its centrality to his research performance. The journal also has an impressive CPP score of 108.46, indicating the substantial

influence of his work within the field. Other notable journals include the *BMJ Case Reports* and the *Diabetes and Metabolic Syndrome: Clinical Research and Reviews (DMSCRR),* each with 24 publications, achieving CPP values of 49.67 and 40.50, respectively. The *Indian Journal of Orthopaedics (IJO)* also stands out, with 21 publications and a high citation count of 1,491, underscoring its regional and thematic relevance. High-impact international journals such as *International Orthopaedics* (11 publications, CPP 13.27) and *Journal of Orthopaedic Surgery and Research* (6 publications, CPP 2.38) further demonstrate his global research footprint. The analysis also reveals a diverse geographical distribution of journals, with contributions spanning countries like India, the UK, the Netherlands, France, and South Korea, showcasing his engagement with both domestic and international platforms. Notably, the journals exhibit varying impact factors (IF 2023), ranging from 0.6 for *BMJ Case Reports* to 4.3 for *Diabetes and Metabolic Syndrome.*

3.3.3.1. Distribution of publications by country and impact factor

We examined the publishing patterns of Dr. Raju Vaishya's 318 publications based on the country of publication and the IF of each journal, as reported in the Journal Citation Reports 2022-2023. In developing countries such as India, publishing in Western journals is often regarded as more prestigious and offers greater mainstream visibility compared to journals from India or other developing nations. The IF is considered by the scientific community as a vital indicator of a journal's reputation, with higher IFs typically reflecting greater scholarly credibility.

3.3.3.2. Distribution of publications by country

Classification of Dr. Vaishya's publications by domestic and international journals (Table 8) reveals that two-thirds (66.67%) of his work appeared was published in domestic journals. In comparison, the remaining 33.35% published appeared in international journals. Among the international publications, the highest share (18.24%) originated from the UK, followed by the USA (4.40%), and China and Germany (2.52% each). Other contributing countries included Nepal, Switzerland, and Turkey (0.63% each), along with seven additional countries accounting for 3.77%. The preference for publishing in the UK aligns with broader trends in Indian scientific output. It reflects Dr. Vaishya's educational background in the UK, which is a common practice among Indian researchers.

3.3.3.3. Distribution of publications by impact factor and journal quartile

The IF is a significant measure of a journal's reputation. In India, papers published in high IF journals are generally perceived to carry more weight than those in lower IF journals. Analysis of Dr. Vaishya's publications by IF reveals that 15.51% (49 papers) were published in 15 low-impact journals (IF < 1). A substantial portion, 69.49% (221 papers), appeared in 42 medium-impact journals (IF 1.0-3.99), while 11.93% (38 papers) were published in seven high to very high-impact journals (IF > 4.0). Additionally, 3.14% (10 papers) were published in journals with an IF of zero (Supplementary Table S4). When classified by quality, as reflected in CiteScore quartiles, Dr. Vaishya's publications showed that around half of them were published in Q1 and Q2 journals, with 75 (23.73%) of the papers were in Q1 (top 25%) and another 75 (23.73%) in Q2 (top 26%-50%; Figure 7).

3.4. Subject-wise analysis

A detailed examination of Dr. Raju Vaishya's 318 publications (excluding letters) provides insight into his contributions across various medical subfields. Of these publications, 228 are dedicated exclusively to orthopedics, 71 are in other areas of medical science, and 19 are categorized as miscellaneous. Among the 238 orthopedic publications, the majority focus on arthroplasty, with 90 papers in this area, followed by 50 papers on general orthopedic topics, 41 on injuries and trauma, and 20 on arthroscopy and sports medicine. The remaining papers cover other subfields within orthopedics. Within the arthroplasty category, the anatomical focus is predominantly on the knee (45 papers) and hip (23 papers), with the rest addressing other anatomical regions. Notably, of the 71 publications in general medical sciences, 52 were focused on COVID-19.

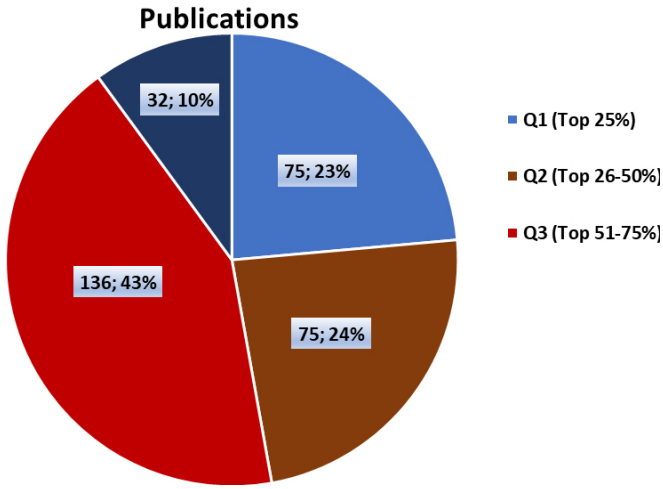

Figure 7. Distribution of Dr. Raju Vaishya's papers by journal quartile.

3.5. Significant keywords

Keywords are vital for accurately indexing research papers. Dr. Raju Vaishya's 318 publications feature a total of 2,953 unique keywords, reflecting his research focus. The most significant keywords, measured by frequency of occurrence, include *Orthopaedics* (59 occurrences, TLS=113), *Covid-19* (57 occurrences, TLS=60), *Arthroplasty* (54 occurrences, TLS=157), *Knee* (37 occurrences, TLS=134), *Fragility Fracture* (35 occurrences, TLS=142), *Osteoarthritis* (34 occurrences, TLS=109), *Knee Arthroplasty* (27 occurrences, TLS=107), *Knee Osteoarthritis* (24 occurrences, TLS=97), *Total Knee Arthroplasty* (20 occurrences, TLS=86), and *Arthrodesis* (19 occurrences, TLS=71).

3.5.1. Co-occurrence analysis

A co-occurrence analysis of 46 selected keywords led to the identification of three major clusters (Figure 8). These keywords and clusters represent Dr. Vaishya's primary research areas and contributions to orthopedic medicine.

- *Cluster 1 (Red):* This cluster includes topics such as Fragility Fracture, Osteoporosis, and Hip Fracture, indicating a focus on bone health and injuries.
- *Cluster 2 (Green):* This centers around knee-related topics, including Knee Arthroplasty and Knee Osteoarthritis, highlighting a significant emphasis on knee surgeries and conditions.

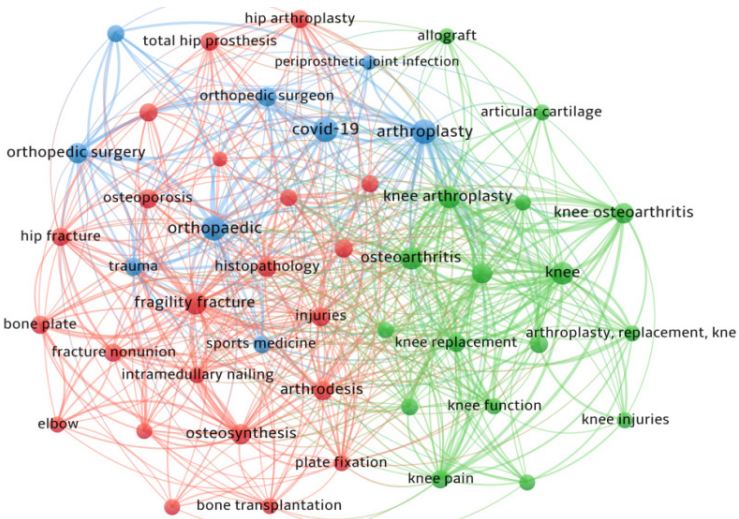

Figure 8. Co-occurrence of the most occurred keywords.

- *Cluster 3 (Blue).* This cluster encompasses broader orthopedic topics such as Orthopedic Surgery and Sports Medicine, along with significant attention to COVID-19.

4. DISCUSSION

The bibliometric analysis of Professor Dr. Raju Vaishya's research output from 2008 to 2024 reveals several significant findings that underscore his contributions to the field of orthopedics. Firstly, Dr. Vaishya's prolific output, with a total of 318 Scopus-indexed publications, highlights his active engagement in research and knowledge dissemination. His publications have collectively garnered 6,834 citations, resulting in an average citation impact of 21.49 CPP. This indicates not only the quantity of his work but also its relevance, influence, and impact within the orthopedic community. A notable aspect of Dr. Vaishya's research is the collaborative nature of his work. An impressive 96.22% of his publications resulted from collaborative efforts, with 55.66% of these collaborations occurring nationally and 29.24% internationally. This high degree of collaboration emphasizes his commitment to interdisciplinary research and his ability to forge valuable partnerships. His most significant international collaborations with institutions in the UK and Italy illustrate the global reach of his work, leading to substantial contributions to the literature, particularly with reputable institutions such as the Southport and Ormskirk NHS Trust and the Royal Orthopaedic Hospital in Birmingham. Research collaboration is crucial for advancing knowledge and solving complex challenges across various fields. By integrating diverse expertise and resources, collaborative efforts improve the quality and scope of research, resulting in innovative solutions and breakthroughs. These partnerships enable the sharing of ideas, foster interdisciplinary approaches, and allow researchers to undertake larger projects that might be difficult for individuals or smaller teams. Collaboration also expands networks, encourages mentorship, and nurtures a culture of learning within the academic community. Ultimately, it enhances the impact of research by translating findings into real-world applications and improving outcomes in both scientific inquiry and practical implementations (HIVO, 2024).

Dr. Vaishya has strategically chosen to publish in high-impact journals, with 33.35% of his research appearing in foreign journals. Notably, a significant portion of his work has been published in UK-based journals, reflecting a focus on reaching a broad audience and contributing to international discourse in orthopedics. Journals such as the *JCOT, BMJ Case Reports,* and *DMSCRR* serve as preferred platforms for sharing his research findings. Publishing in high-impact journals offers numerous advantages for researchers. These journals have a wide readership and are well-regarded in the academic community, which enhances the visibility and reach of research, potentially leading to higher citation rates. Publishing in such journals also adds credibility and prestige to the author's reputation, benefiting their career prospects. Published articles in these journals can attract attention from industry and policymakers, facilitating real-world applications of research findings. Finally, being published in high-impact journals connects researchers with a network of esteemed professionals, fostering collaboration and future research opportunities (eContent, 2023).

The identification of a subgroup of HCPs —representing 8.49% of his total output and collectively receiving 4,920 citations— further highlights the impact of his most influential work. The high average CPP of 182.22 among these papers underscores their significance in advancing the field of orthopedics, particularly in areas related to arthroplasty and arthroscopy. The HCPs significantly influence the academic landscape and beyond (Aksnes, 2003; Vaishya, Gupta, & Kappi, 2024; Vaishya, Gupta, & Mamdapur, 2024; Vaishya *et al.,* 2023). They enhance the visibility and recognition of authors, establishing them as leaders in their fields, which can lead to greater collaboration, funding, and speaking opportunities. These papers often introduce innovative ideas and methodologies that shape future research, influencing theories and practices within disciplines. High citation rates are also viewed as indicators of quality and relevance, prompting funding bodies and academic institutions to prioritize such work. This bibliometric analysis showcases the breadth and depth of Dr. Vaishya's scholarly contributions also reinforces his status as a leading figure in orthopedic research. His extensive collaboration network,

strategic publication choices, and the impact of his highly cited work serve as an inspiration for current and aspiring researchers, emphasizing the importance of collaboration and engagement in producing impactful science.

5. CONCLUSION

This bibliometric analysis of Professor Dr. Raju Vaishya's research from 2008 to 2024 highlights his significant contributions to the field of orthopedics, reflected in his impressive total of 318 publications and an average citation rate of 21.49 per paper. A remarkable 96.22% of his work involves collaboration, with substantial partnerships both nationally and internationally, notably with institutions in the UK and Italy. Dr. Vaishya's strategic publication choices in high-impact journals have facilitated the dissemination of his research to a global audience. Additionally, his highly cited papers, accounting for 8.49% of his total output, underline the substantial influence of his work in areas such as arthroplasty and arthroscopy. This analysis highlights Dr. Vaishya's vital role in advancing orthopedic research and serves as an inspiration for future scholars in the field.

Conflict of interest

The authors declare that there is no conflict of interest.

Contribution statement

Conceptualization, literature search, writing and editing the manuscript, final approval, and submission: Brij Mohan Gupta.

Conceptualization, literature search, data curation, formal analysis, writing the manuscript: Mallikarjun Kappi.

Conceptualization literature search, data curation, formal analysis, writing and editing the manuscript, final approval: Abhishek Vaish.

Literature search, data curation, formal analysis, writing and editing the manuscript, final approval: Mohit Kumar Patralekh.

Statement of data consent

The data generated during the development of this study have been included in the manuscript.

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Supplementary Table S1. Five to six cumulative publication productivity and collaboration rate of Dr. Raju Vaishya during 2008-2024.

Five to six cumulative number (years)	Single-authored paper	Multi-authored papers total	Total papers	Collaboration rate	Publishing age	Actual age
2008-2013	2	16	18	0.88	1-6	48-53
2014-2019	6	86	92	0.93	7-12	54-59
2020-2024	4	204	208	0.98	13-18	60-65
Total	**12**	**306**	**318**	**0.96**	**18**	**65**

Supplementary Table S2. Authorship distribution of papers of Dr. Raju Vaishya during 2008-2024.

Five to six cumulative number (years)	Number of authors in each paper										TP	Collaboration coefficient
	1	2	3	4	5	6	7	8	9	11		
2008-2013	2	1	10	3	1	1	0	0	0	0	18	0.61
2014-2019	6	15	24	36	6	5	0	0	0	0	92	0.65
2020-2024	3	29	53	45	33	23	11	6	2	3	208	0.72
Total	**12**	**47**	**90**	**88**	**45**	**35**	**18**	**14**	**11**	**14**	**318**	**0.66**

Note. TP: Total papers.

Supplementary Table S3. Publication productivity of Dr. Raju Vaishya with position of Dr. Raju Vaishya in author by lane.

Period	Number of papers with position of Dr. Raju Vaishya in author by lane										Total papers
	1	2	3	4	5	6	7	8	9	10	
2008-2013	14	3	1	0	0	0	0	0	0	0	18
2014-2019	74	11	5	2	0	0	0	0	0	0	92
2020-2024	71	28	46	22	18	10	9	2	1	1	208
Total authors	**159**	**42**	**52**	**24**	**18**	**10**	**9**	**2**	**1**	**1**	**318**
Authors (%)	**50**	**13.21**	**16.35**	**7.55**	**5.66**	**3.14**	**2.83**	**0.63**	**0.31**	**0.31**	

Supplementary Table S4. Distribution of papers by impact factor.

S No.	IF range	Level of IF	Number of journals	Number of papers	Percentage of papers
1	0.0-0.99	Low	15	49	15.41
2	1.0-1.99	Medium	17	173	54.40
3	2.0-3.99	Medium	25	48	15.09
5	4.0-5.99	High	5	36	11.31
7	6 and above (10.0-50.5)	Very high	2	2	0.62
8	Not available		5	10	3.14
	Total		**69**	**318**	**100.00**

Note. IF: Impact factor.

Supplementary Table S5. Distribution of citations of papers of Dr. Raju Vaishya

Citation slab	TP	TP (%)	TC	TC (%)
0-0	54	16.98	0	0.00
1-5	126	39.62	344	5.02
6-10	50	15.72	400	5.83
11-20	33	10.38	481	7.01
21-50	29	9.12	880	12.83
51-100	15	4.72	1,040	15.16
101-967	11	3.46	3,714	54.15
Total	**318**	**100.0**	**6,859**	**100.0**

Note. TP: Total papers; TC: Total citations.